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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 15.] MARCH. [1888.

XXXII.—FORSTERONIA RUBBER.

(*Forsteronia gracilis*, Benth.)

The flora of British Guiana is in course of being carefully and intelligently investigated by Mr. Jenman, the Government Botanist and Superintendent of the Botanic Garden at Georgetown. The critical determination of the plants is carried on at Kew, where typical specimens are added to the collections of Guiana plants already existing in this establishment. Among the plants for which we are indebted to the zeal and sagacity of Mr. Jenman there are many of economic value. Recently we received from him dried botanical specimens and sample of rubber from a plant locally called Macwarrieballi, not hitherto known to yield caoutchouc. A botanical examination of the specimen by Professor Oliver proved that this plant was a species of *Forsteronia* (*F. gracilis*, Benth.), a genus of *Apocynaceæ*. This family is extremely rich in india-rubber plants, and comprises all those which yield rubber of African and Malayan origin. The plant under notice appears from Mr. Jenman's account to be "a large twining plant, the stem of which "trails on the floor of the forest, snake-like, and the head spreads over "the tops of the highest trees above." He continues: "the flowers "are not quite out. I send also a sample of the rubber, which, if you

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" could obtain a report on, I should be greatly obliged. It is dis-
" coloured from the creek water in which it was washed, the only kind
" of water that was there obtainable. The fresh milk seems to be
" rich beyond any I have before found in caoutchouc. The only
" defect I experienced is that it dries slowly, remaining sticky for some
" time."

Through the kindness of Mr. S. W. Silver, F.L.S., to whose good offices in connection with the investigation of numerous samples of rubber this establishment is greatly indebted, we have been favoured by the India-rubber, Gutta-percha, and Telegraph Works Company, Limited, of Silvertown, with an interesting report, dated 20th January 1888, upon the properties of this new kind of rubber from British Guiana. We are informed that the substance possessed "so many
" valuable properties, that it would be well to ascertain whether a
" larger quantity could be placed in our hands for further experimenting.
" The present quantity is far too small to enable any one to say whether
" it would be practicable to extract or utilise the large quantity of
" caoutchouc which it contains, so as to give this substance a position
" of commercial importance.

" We note the remark as to its being 'discoloured by being washed
" 'in peaty water'; this treatment has in no way interfered with our
" being able to report upon it. One side of it is coated with a brownish
" substance of a resinous character, and is evidently produced either
" by oxidation of the resin itself, contained in this substance, or from
" some other cause.

" The substance, as it is, cannot be worked at all with the present
" india-rubber appliances; this is due to its adhesiveness. This intro-
" duces the serious difficulty of removing water from it by any ordinary
" process of drying, which is *essential* with india-rubber.

" On removal of the resin, the caoutchouc is recovered in a soft,
" sticky condition, quite unfit for manipulating as india-rubber.

" When a substance of such promise is sent for examination, it is
" not only important that a larger supply should be available for the
" purposes of a preliminary examination, but for subsequent experi-
" ments; frequently an application has been found for a vegetable
" product by accident, from being able to fall back upon it, as it were,
" as opportunity presents itself."

So far, there appear good grounds for believing that if the plant from which the rubber was extracted exists in any quantity in the interior of Demerara, the collection of the rubber would be a very promising commercial undertaking.

In connection with this subject, it may be useful to draw attention to the fact that another species of *Forsteronia* (*F. floribunda*), called in Jamaica milk-wythe or green-wythe, has long been known to yield caoutchouc. In the Report of the Director of the Botanical Department, Jamaica, 1883, p. 17, it is stated that, "an indigenous plant,
" known as the 'green withe' of Jamaica, yields excellent rubber, a
" specimen of which was sent to me by the Rev. E. Bassett Key.

" This plant, probably a species of Echites [*Forsteronia*], is found
" only in the interior woods of Manchester and St. Elizabeth, and, so
" far, I have been unable to obtain specimens in flower or fruit."

In the Report for the year 1884, pp. 46–47, it is further stated that the "indigenous plant, known as the 'milk-withe,' found in the moun-
" tains of Manchester and St. Elizabeth's, yields an excellent rubber.

" A specimen of what I believe to be the same rubber was
" presented some years ago to the Museum of the Pharmaceutical

" Society of Great Britain by Mr. John Sawyers, of Derry, in the " parish of Manchester.

" The plant yielding this rubber has now (thanks to further speci- " mens sent to me by Mr. Bassett Key) been determined at Kew as " *Forsteronia floribunda*," G. Don.

XXXIII.—PATCHOULI.

(*Pogostemon Patchouli* var. *suavis*.)

Patchouli is a well-known scent obtained by distillation from the leaves of a cultivated variety of *Pogostemon Patchouli*. It first became familiar in Europe as a characteristic odour associated with Indian shawls. The leaves are sometimes used in a powdered state for scenting drawers, after the manner of the old-fashioned lavender bag. The otto or essential oil is of a dark brown colour, with an odour said to be more powerful than any obtained from the vegetable kingdom. The chief supply of Patchouli appears to come from the Straits Settlements and islands in the Eastern Archipelago, including Java.

Fuller particulars respecting Patchouli and its uses may be obtained from the Art of Perfumery, by Piesse, p. 174, and Spon's Encyclopædia of Industrial Arts, Div. IV., p. 1425.

The present note brings together the information which has reached this establishment lately respecting the actual source of Patchouli and its present commercial value.

In Mr. Cantley's Report on the Forest Department of the Straits Settlements for 1886, he says:—" Plants of Patchouly have been in " demand for experimental planting, and a good number have been " supplied. Picked leaves are now selling at 17 dollars per picul. " The plants grow freely with but little care, and should figure among " colonial products. Plants raised from seed are reported to grow " well, but to have no scent, but retain it when produced from cuttings. " I have not been able to verify these statements, but it is well known " that plants do sometimes play tricks of this kind."

In September last the following letter was received from Mr. C. Curtis, Assistant Superintendent, Forest Department, at Penang:—

" Penang, 17th August, 1887.

" I have the honour to advise you of the despatch, per S.S. 'Khedive,' " of one small case, containing dried plants for determination, and " samples of Patchouli for an opinion as to their market value.

" The latter are from the Experimental Nursery, where one-twentieth " of an acre has just been harvested, and some valuable experience " gained as to cost of cultivation, loss of weight in course of prepara- " tion, &c., details of which will be supplied in due course.

" The samples numbered 1 and 2 consist of picked leaves, and stems " and leaves together, the system of drying having been the same in " both cases.

" Sample 3 is dried leaves of *Urena lobata*, L., var. *sinuata*, largely " used to adulterate Patchouli; and it would be interesting to know " whether it contains any useful property or is added entirely to " increase the bulk. This is not cultivated, but found growing wild " in considerable quantity in cocoa-nut gardens and waste places near " the coast. For mixing with Patchouli it fetches from three dollars " to four dollars per picul (133⅓ lbs.), dried as per sample.

"I trust you will not think me troublesome when I ask you to be "good enough to submit the three samples to a competent judge of "their market value, and by so doing you will be conferring a benefit "on agriculture, as we shall be enabled to form a definite opinion "whether extended cultivation will prove profitable or otherwise.

"Any information respecting the preparation, probable future "demand, &c., would also be of great assistance.

"C. CURTIS."

The specimens received from Mr. Curtis were forwarded to Messrs. Piesse and Lubin, of New Bond Street, who were good enough to report upon them, as follows:—

"2, New Bond Street,
"8th October 1887.

"The sample No. 1 is excellent. The commercial value we estimate "to be about 80*l.* or 100*l.* per ton. No. 2 is less valuable *pro rata* for "the weight of stalks, which have no odour, and yield no attar on "distillation. No. 3 you correctly describe as being used for the "adulteration of the genuine leaves. We always find it in the "Patchouli leaves we purchase for perfumery purposes. If it yielded "an odourous essential oil on distillation, that would possess some "commercial value. The sample appears to us, however, to have but "a very slight camphoraceous odour.

"We are expecting shortly the first consignment of Patchouli leaves "from Mr. J. C. Fillan, who is growing it experimentally in Dominica.

"The demand for both leaves and attar of Patchouli, though not "very great, is steady and continuous. The attar fetches about 2*s.* 6*d.* "to 3*s.* per oz. weight.

"PIESSE AND LUBIN."

Similar specimens were forwarded to Messrs. Burgoyne, Burbidges, Cyriax, and Farries, who obligingly sent the following report:—

"16, Coleman Street, 12th October 1887.

"I am in receipt of your favour of the 3rd ultimo, together with "samples of leaves. The sample 1, *Pogostemon Patchouli*, is good, "small, free from stalks, and worth about 1*s.* per lb. No. 2 is very "stalky but fair flavour, worth about 4*d.* to 5*d.* per lb. No. 3, "'Bupulut,' is not known on the market and is of no commercial "value. I doubt if it contains any useful property, and should think "it would only be added to increase the bulk of Patchouli.

"These valuations I have given you would apply to shipments of "about five tons; if a large parcel, say 20 tons, were suddenly put on "the market, values would probably decline. It is, therefore, advisable "to exercise caution in making shipments. At the present moment "there is a very fair demand for good leaves. Any further information "you require I shall be happy to give you.

"BURGOYNE, BURBIDGES, CYRIAX, AND FARRIES."

On the present position of the market, as regards Patchouli leaves, Mr. R. C. Treatt was good enough to supply us with the following information:—

"Mincing Lane, E.C.,
"20th October 1887.

"Referring to my letter of this date, I am glad to be able to give "you a little information of a business character *re* Patchouli.

"The supply is somewhat limited in this market, and the quality of "leaves arriving here not, as a rule, quite satisfactory. The quality "most sought after is the sample No. 1, which you sent to Messrs. Piesse "and Lubin, *i.e.*, a fairly long leaf without stalks. The presence of "many stalks in a bale of leaves reduces its value fully 25 per cent.

"There is ever a good demand for leaves, as the London market "supplies the Continent as well as England. Buyers would always "prefer to buy the oil itself, but, as a rule, distillers in the East "adulterate it. If a *genuine* oil could be shipped, it would fetch "3*s*., 3*s*. 6*d*., 3*s*. 9*d*. per oz. Packages, cases of 12 and 22 oz. bottles. "The leaves are shipped in bales, 200 lbs. each, and fetch, if good, 1*s*. "to 1*s*. 3*d*. per lb., less 2½ per cent. The present demand is *good;* 50 "to 100 bales would sell were they here and of good quality.

"Should the Government of the Straits Settlements decide to ship "the leaves or the oil, I should be glad to receive consignments and "sell them on the market for 3 per cent. commission, or to buy them "outright, subject to approval of quality.

"Should you think of any other information which I might, in my "business capacity, be able to give you, I shall be pleased to give you "same.

"R. C. Treatt."

The above information will, no doubt, prove acceptable to correspondents in tropical Colonies, and it will, at the same time, usefully serve to meet an inquiry which has reached this establishment respecting Patchouli from the Government of India.

In a letter dated Simla, 5th August 1887, the Revenue and Agricultural Department desired to be furnished with information "regarding "the growth of the Patchouli plant in Assam, especially with reference "to the following points: (*a*) is the plant grown to any extent in Assam "and the Khasia Hills, and is it the *Plectranthus Patchouli* or (the "true plant) *Pogostemon Patchouli?* and (*b*) can its cultivation be "generally extended; more particularly, can it be cultivated in Bengal"? To this, the following reply was addressed to the India Office:—

"Royal Gardens, Kew, 30th January 1888.

"The true Patchouli plant is free from ambiguity, it is the *Pogostemon Patchouli* described and figured by Sir William Hooker in the "Kew Journal of Botany, vol. i., p. 328, t. 11, from cultivated "specimens. This stands in the Flora of British India (vol. 4, p. 634) "as *Pogostemon Patchouli*, var. *suavis*. My colleague, Prof. Oliver, "the keeper of the herbarium of the Royal Gardens, is of opinion that "it is doubtful whether this particular form, which is the economic "plant of commerce, is indigenous in any part of India. I agree with "him in this opinion, as also in thinking that it may ultimately prove "to have originated in China.

"It may be laid down then as certain that the true economic "Patchouli plant is accurately known, though at present of obscure "origin. It is equally certain that it is abundantly cultivated in the "Straits Settlements. The Patchouli of commerce is, as far as India "is concerned, an exotic production. I may remark, however, that "Dr. King, the Superintendent of the Royal Botanic Garden, Calcutta, "when recently in England, informed us that there is a plant known at "Calcutta as Patchouli, that it does not flower, but that, as far as his "memory served, it did agree with the true plant figured by Sir William "Hooker. Nothing of course can be more probable than that it has "been introduced into cultivation at Calcutta from the Straits.

"There is no evidence whatever in the Kew herbarium of the "existence of any form of *Pogostemon Patchouli*, scented or scentless, "in the Khasia or Assam region.

"There appears to be evidence, however, of the existence of a plant "with a Patchouli odour, native to Khasia and Assam. What this "plant may be is doubtful; but it is certainly not the Patchouli of "commerce. It finds a place in the Flora of British India, vol. 4, "p. 624, as a doubtful *Plectranthus* (*Plectranthus Patchouli*, Clarke). "Whatever it may be, it is widely different from any form of *Pogostemon* "*Patchouli*. But it is, of course, not denied that if it has the true "odour it may have a commercial use in India. There is no inherent "scientific improbability in widely different plants elaborating the same "essential oil. That, however, is a point to be worked out upon the "spot, upon which I can give no opinion.

"What may be regarded as feral states of *Pogostemon Patchouli*, "probably usually scentless, are commonly indigenous in the Western "Peninsula, from Bombay southwards. There may, however, be local "scented forms which are cultivated, and, for aught I know, the true "commercial Patchouli plant may be cultivated in Indian gardens in "the Peninsula. All this can only be ascertained by inquiry. If dried "specimens of plants used as Patchouli could be obtained from different "parts of India, the matter could be very readily settled by botanical "investigation at Kew.

"W. T. Thiselton Dyer."

XXXIV.—WEST AFRICAN INDIGO PLANTS.

Judging by the number of specimens sent to Kew, and the inquiries made respecting them, it is evident that considerable activity exists on the West Coast of Africa in regard to plants of economic value. During the last three weeks, 10 specimens of so-called Indigo plants have been forwarded by different correspondents. Some of these have been nothing more than the ordinary Indigo plants *Indigofera tinctoria*, and *I. Anil*, which it is well known are plentifully distributed in West Africa. Others have consisted of leaves of the Yoruba Indigo, *Loncho carpus cyanescens*, Benth., which has been already investigated at Kew, but of which specimens of flowers and of fruit are still wanting to complete the material for identification.

In one case, fruits of *Randia malleifera*, Benth., have been sent. The inky sap of this fruit, locally called "Blippo," is used by the Niam-Niam and the Monbuttoo to dye themselves. The juice at first is described by our correspondent as colourless, but it is said to develop a deep blue colour in a day or two. The fruits of *Gardenia sp.* near *Gardenia Thurnbergii*, and the seeds of *Cremaspora africana* were also sent as yielding Indigo, but apparently under a mistaken idea that they were identical with the species of *Randia* above mentioned. A quantity of what appeared to be the corms of an aroid plant, disc-shaped and about half-an-inch in diameter, were recently received from Old Calabar, as "beans which make a blue dye of a very fast colour." The specimens contained starch in an appreciable quantity, but apparently they possessed no special properties which would render them useful for dyeing purposes.

So far there is nothing to indicate that any of these Indigo plants, other than *Indigofera*, are likely to prove of commercial value. The

ordinary indigo plants (either *I. tinctoria* or *I. Anil*), are already under cultivation by the natives, but the preparation is so crude and inefficient that the produce is not likely to compete successfully with Indian and other sources of Indigo.

The most promising plant, next to species of *Indigofera*, is no doubt that already mentioned as yielding Yoruba Indigo. In a paper, read before the Linnean Society [Journ. Linn. Soc., vol. xx., p. 404], Mr. Thiselton Dyer, F.R.S., gave an account of this plant, which, in view of the revival of the subject, it may be well to place within reach of correspondents and others interested in West African products :—

"It has long been known from the observations of travellers, that " the natives of the West Coast of Africa obtained an abundant supply " of Indigo from plants cultivated for the purpose. And, as the species " of the genus *Indigofera* have their head-quarters in the African " continent, it was not perhaps an unreasonable supposition that one " or more of them was the source of the dye in use amongst the " inhabitants of the West Coast.

"It was therefore with some surprise that I found amongst a " number of specimens received at the close of last year from Captain " Alfred Moloney, C.M.G., Administrator of the Gold Coast Colony, " a specimen of an arborescent leguminous plant, but obviously not an " *Indigofera*, marked as yielding a native Indigo. I drew Captain " Moloney's attention to the interest attaching to the matter ; and, as " the specimens received consisted merely of foliage, I urged him to " secure additional material sufficient for a botanical determination. " He replied to me, on April 10, from Lagos, as follows :—

"' I am glad to find I have sharpened your appetite as to the Indigo. " ' The country abounds with it ; but as the young shoots are the " ' parts from which the dye is made, you can realize the difficulty of " ' securing flower and fruit. I do not despair, however. . . . . " ' . . . . This tree might be largely developed here. It is climber, " ' and must be leguminous. The Yoruba for the tree is "Elu." '

"I placed Captain Moloney's material, such as it was, in the hands of " my colleague Professor Oliver, who unites to a knowledge of the " affinities of plants, which has become almost an instinct, an " acquaintance with the contents of the vast Kew Herbarium in which it is " safe to say that no human being will ever surpass him. He speedily " drew my attention to a specimen (3360) brought back from the Niger " expedition by Barter in 1859. It is accompanied by a manuscript " note, which I transcribe :—

"' Indigo of the Yoruba country. Leguminous shrub of twining " ' habit and large growth. Flowers in loose panicles, at first pink, " ' changing to a faded blue. Common near rivers ; plantations of " ' several hundred acres of this are about Abbeokuta. In cultiva- " ' tion the plant is kept about 7 or 8 feet high ; long shoots " ' are cut close, and it becomes short and spurred and bushy, like " ' *Wistaria sinensis* when similarly treated. The leaves are gathered " ' young (as seen in the specimen), merely powdered in a mortar into a " ' black pasty state, made into balls the size of double fists, and dried " ' for the markets. In dyeing, one ball to a gallon of water is used ; " ' the cloth allowed to remain four days. The dye is fixed with " ' potash ; a fine deep blue is produced, very permanent.' "

It is most desirable that good specimens of the flowers and pods of the plant yielding Yoruba Indigo should be sent to Kew for further investigation. We trust that some of our correspondents on the West Coast will bear this in mind.

XXXV.—VANILLA.

The cultivation of Vanilla has been attempted in numerous tropical Colonies, but, with the sole exception of Mauritius and the Seychelles, it does not appear to have assumed an important position in any British Colony. This is due to a variety of circumstances. In some Colonies the climate may be unsuited to the successful growth of the plant, owing to seasons of extreme severity in droughts or heavy rains. In others, the soil may be too retentive. In most of them, the need which exists for artificially fertilizing the flowers of Vanilla, and the care necessary to properly cure the pods have, no doubt, contributed to retard the cultivation. There are, however, no valid reasons why the cultivation of Vanilla in certain portions, at least, of the West Indian Colonies, of British Honduras, of the West African Settlements, of India, Ceylon, and the Straits Settlements should not be successfully pursued. With that view, plants of Vanilla have been forwarded from Kew to certain Colonies where they did not previously exist, and it is proposed now to give very briefly the chief points bearing upon the industry.

The Vanilla plant is an orchid of climbing habit, of which there are probably several species under cultivation. The more common plant appears to be *Vanilla planifolia*, Andr. (*V. claviculata*, Sw.) Other species under cultivation are *V. aromatica*, Sw., and *V. grandiflora*, Eich. The botany of the plants yielding Vanilla requires to be carefully investigated. The specimens in the herbarium of this establishment in their present state throw little light on the subject. Hence, a good series of leaves, flowers, and fruits of plants yielding Vanilla, carefully dried, or preserved in spirit, would be a valuable addition to the collections.

It appears that *Selenipedium Chica*, Rchb. f. (Xenia Orchidacea, Vol. I., p. 3, t. 2), yields Vanilla on the Isthmus of Panama, which is described by Seeman (Botany of Herald, p. 215) as follows:—

"The fruit of this plant is highly esteemed as an aromatic by the "inhabitants of the Isthmus [Panama], and used for all purposes for "which real Vanilla is commonly used. It is termed 'Vanilla Chica,' "or 'Little Vanilla,' because its fruit is very much smaller than that of "any of the genus Vanilla found in the Isthmus."

Cultivation.—As regards starting a Vanilla plantation, it is important to bear in mind that the plants, being climbers, it is necessary to provide them with support of some kind, and generally, for this purpose, rough-barked trees, trellis-work, stone pillars, or stone walls are utilized. Living stems of rough-bark trees are probably the best supports for Vanilla. In Mauritius, the Seychelles, and Réunion, the stems of *Jatropha Curcas* are largely used. In addition to support, the Vanilla plants require a certain amount of shade. This, however, should not exceed what is called half-shade (*demi jour*). A certain amount of sun is, however, essential to the proper ripening of the pods. Whatever the support or nature of the shade may be, it is important to bear in mind that the Vanilla plants should be kept within easy reach of the cultivator, and not allowed to climb high up amongst the branches.

The ground around the support should be prepared by deep trenching to the depth of a foot or 18 inches. The drainage of the bed should be perfect. The most favourable soil consists of fine rich loam, mixed with equal parts of sand and leaf mould. Rich animal manure, or manure of any kind, is not a desirable addition. To renovate the soil at the end of the season, add some well-rotted vegetable mould or humus mixed with sand. Raise the bed about six inches above the surrounding

surface and support by means of stones or rockwork. Where obtainable, the cuttings should consist of portions of stems about two or three feet long, but all the better if four or five feet long. The leaves are first removed from the lower part, and three joints are laid under the soil and covered to a depth of two or three inches. The upper part of the stem is trained against the support in the position in which it is intended to grow. A single tree will carry several Vanilla plants, depending upon its size. The surface of the bed should be kept moist by being covered with leaves or "mulching," and, in very dry weather, it should be regularly watered.

Thus started, Vanilla cuttings readily take root, and the stem will grow and flourish. Depending upon the size of the cuttings, the plants begin to flower in the second year after planting. They do not, however, flower freely until the third and fourth years.

Fertilization of the Flowers.—The first duty of the cultivator when the plants are in flower is to attend to the duty of fertilization which, in countries where the Vanilla is not a native, will require to be done artificially. The flower of the Vanilla, as in most orchids, is a very highly differentiated organ, the parts of which can be best studied by a reference to the engraving given on page 79. In the wild state, the pollen is carried to the stigma of the Vanilla flower by means of the agency of insects. Where these particular insects are absent, their work must be performed by the cultivator, or no Vanilla pods will be produced.

It is recommended that the work of fertilization should take place in the morning. It is advisable that all the flowers in a cluster be fertilized as they open; but of those that are successfully fertilized, only a certain number, depending on the age and strength of the vine, should be allowed to remain. If too many pods are retained at first, the vine is apt to be weakened, and the quality of the produce lowered.

The process of fertilization will be better understood by a reference to the engraving given herewith. The only instrument necessary is a small piece of bamboo or sharpened stick the thickness of a lead pencil, about four or five inches long.

When the flower is opened, it will be noticed that there are three outer and three inner floral parts, which are sometimes designated the sepals and the petals respectively. One of the latter is so much altered and so distinct in form and colour, that it is usually spoken of as the *lip*. Inside, and immediately hanging over the free part of the lip, is a process which is a continuation of the axis of the flower. This is called the column (*see b*, fig. 2). The end of the column enlarged, front view, is shown at fig. 4. At *a*, fig. 5, is represented the anther, containing the pollen masses, and at *b*, the stigma or viscid surface, on which the pollen must be placed in order to ensure the act of fertilization. At fig. 6 is represented a section through the top of the column showing the position of the pollen masses *a*, and the stigma *b*. It will be noticed that the stigma is separated from the pollen masses by an upper lip projecting over the stigma. In the work of fertilization it is necessary to lift up or tear away this lip, and transfer the pollen masses from the anther at *a* to the stigma at *b*, as shown in fig. 7. The mode of using the instrument is shown at figs. 2 and 3.

The work of fertilization, when once understood, may be carried on with great rapidity. An expert person will, it is said, fertilize as many as a thousand flowers in one forenoon. The simplest mode is to seize the flower with the left hand between the thumb and middle finger, and support the column at the back with the forefinger. Then, with the sharpened instrument in the right hand, the hood at the top of the

Explanation of Plate.

Fig. 1.—Portion of stem of Vanilla plant, with leaf, aerial root, and cluster of flowers; *a*, front view of Vanilla flower; *b*, side view; *c*, aerial root, with root hairs,

Fig. 2.—Single flower of Vanilla, exhibiting the first stage in the process of artificial fertilization. The operator, provided with a finely-pointed piece of bamboo, divides the lip or labellum medially, so that the central lobe is separated from the two side lobes. This exposes the column and organs of fecundation. The instrument is represented as placed against the column, ready to press upwards the anther *a*, and bring the pollinia in contact with the stigma *b*.

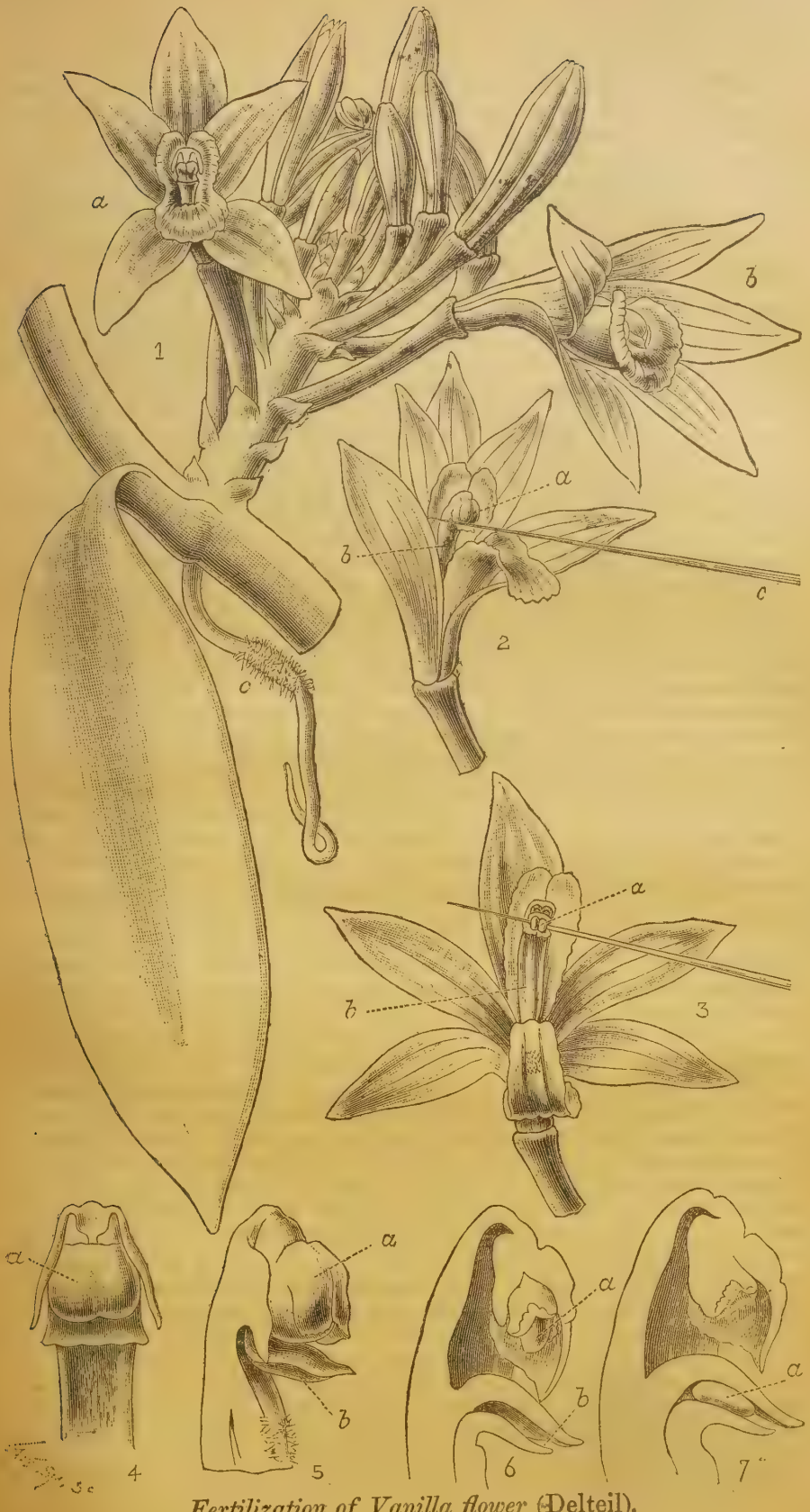
Fig. 3.—Single flower of Vanilla, exhibiting the second stage in the process of artificial fertilization; *b* shows position of column exposed by division of the lip [the middle lobe of lip is pulled forward and curled upon itself to show the position of the column; the side lobes of lip, separated as shown in Fig. 2, are represented at back of the column]; *a*, the position of pollen masses, taken from the anther and placed on the stigma.

Fig. 4.—Enlarged front view of top of the column; *a*, the anther.

Fig. 5.—Enlarged side view of top of the column; *a*, the anther; *b*, the stigma, or viscid surface on which the pollen masses must be placed to ensure fertilization.

Fig. 6.—Enlarged section through top of the column; *a*, one of the pollen masses *in situ*; *b*, the stigmatic cavity.

Fig. 7.—Enlarged section through top of the column; *a*, the pollen masses, having been transferred from *a*, Fig. 6, are now represented in contact with the stigmatic surface. [Although diagrammatically shown, these figures give a tolerably good idea of what is actually necessary in order to produce fertilization in a Vanilla flower.]



Fertilization of Vanilla flower (Delteil).

column is removed, so as to expose the anther and stigma. The upper lip of the stigma is then pressed upwards, and the anthers brought down and placed in contact with stigmatic surface, as shown in figs. 3 and 7. The explanations given to the figures in the engraving will clearly show the operations here described. When the flowers have been fertilized they will begin to wither about the third day. By the end of the first month the fruit attains nearly its full size, although it is not fully developed until it is six or seven months old.

Curing the Pods.—The pods are left on the vine until they begin to show a slight yellow tinge at one end. They are then gathered from day to day, care being taken not to injure those not yet fit to gather. When the day's gathering is completed, the pods are placed in a basket, and, according to one method of preparation, they are plunged for about half a minute in very hot, but not actually boiling, water. Directly after this operation the pods are spread out on mats to drain. For the next six or eight days they are exposed on woollen cloths or blankets in the sun, while each night they are kept in a closed box, where they undergo a certain amount of fermentation. When they have become soft and brown, the pods are placed to dry in the shade, they are carefully and regularly pressed between the fingers, slightly anointed with oil, and rendered supple and lustrous. When quite cured, the pods are of a rich dark chocolate colour, pliable in texture, and perfectly free from moisture. The whole process of curing extends over several weeks.

In packing for the market, the pods are sorted according to length, and put up in packets of 50 pods each; they are tied in the middle, and also near each end. These packets are then carefully put up in closely fitting tin boxes. When Vanilla pods are in good condition, they become covered with an efflorescence of needle-like crystals of Vanillic acid. The interior of the bean is then soft, unctuous, and balsamic.

Those who wish to carefully study the various modes of growing and curing Vanilla, cannot do better than consult *Vanilla, its Cultivation in India*, by J. E. O'Connor, Calcutta, 1881; and *La Vanille, sa Culture et sa Préparation*, par A. Delteil, Paris, Challamel Ainé, 2, Rue Jacob, 1884.

Vanilla plants have been frequently grown and fruited in this country at Kew, at Sion House, and other establishments. In 1878, some bunches at Sion House contained as many as fifteen pods, each of which measured nine inches in length.

Mr. Piesse gives the following interesting information respecting the use of Vanilla pods for perfumery purposes:—

"In order to obtain the perfume or essence, ½ lb. of such pods are cut "up small, and put into one gallon of pure alcohol, of a strength known "as 60° over proof, giving the whole a shake-up daily. The ingredients "must remain together for, say, four weeks, at which time all that is "worth extracting will be found in the spirit, which may then be "strained off quite clear and bright. It is then suitable as a flavouring "agent, or, when blended with other scents, it makes delicious per-"fumery. Those sold under the titles of clematis, heliotrope, wall-"flower, &c., mostly contain about one half in bulk of Vanilla extract. "About two centuries ago, Vanilla may be said to have been unknown "in this country; it is, however, stated that Morgan, an apothecary, "showed to Queen Elizabeth a sample, but he knew nothing more about "it than that 'it was brought from abroad by some Spanish mer-"chants.' At the present time the total annual average crop of all the "varieties of Vanilla from the several countries which produce it "may be estimated at 80,000 lbs., representing a value of not less than "150,000*l.*"

XXXVI.—STREBLUS PAPER.

(*Streblus asper*, Lour.)

The preparation of paper and even cloth from the bark of the Paper Mulberry (*Broussonetia papyrifera*) is a circumstance which is well known. Various specimens, illustrating the uses of the bark of this plant, exist in the Museums of Economic Botany at Kew from China, Japan, and the Pacific Islands. It appears that in Siam paper very similar in character to that prepared from *Broussonetia*, is obtained from *Streblus asper*, Lour. This latter is a tree widely distributed throughout India, Ceylon, and tropical Asia, where it is known under a variety of native names. It does not appear, however, that it is used for paper making to any appreciable extent in any country except Siam.

The following correspondence, which has taken place between this establishment and the Foreign Office, contains practically all the available information on the subject :—

"Kew, 25th April 1887.

"I have the honour to inform you that I observe in the Paper "Makers' Monthly Journal an account, based on information acquired "by the late Sir Richard Schomburgh, of the manufacture of paper in "Siam from the bark of *Streblus asper* (otherwise *Trophis aspera*), "a tree locally known as Ton-Khoi.

"It is stated that legal documents and Government correspondence "are written on paper made from this material. Black paper, written "upon with talc, is also stated to be used for rough drafts.

"The tree is a common one in the East generally, and it therefore "seems worth while to obtain some information about its use in the "manufacture of paper. The Museum of the Royal Gardens possesses "no specimens illustrative either of the raw material or of the product "derived from it.

"I venture, therefore, to express the hope that the Secretary of "State will approve of the kind offices of the Minister Resident at "Bangkok being invited to assist this establishment in procuring "specimens (1) of the raw material in its several stages; (2) of any "characteristic implements employed in the manufacture; (3) of "finished samples of the paper.

"It would be also desirable that the collection, if made, should be "accompanied by a dried specimen of the foliage, and, if possible, "flowers of the tree, in order to make the identification perfectly "secure. Any moderate expense incurred will be defrayed by this "establishment in usual course.

"W. T. Thiselton Dyer."

"Foreign Office, 10th December 1887.

"With reference to your letter of the 26th instant, I am directed by "the Marquis of Salisbury to transmit to you a despatch from Her "Majesty's Chargé d'Affaires at Bangkok, forwarding a report of the "manufacture and uses of Ton Khoi paper.

"P. W. Currie."

"Bangkok, 28th October 1887.

"In obedience to instructions contained in your Lordship's "despatch, No. 21, of 29th April 1887, I have now the honour to "enclose a report, prepared by Mr. Beckett, Student Interpreter of

" this Legation, with regard to the manufacture of paper from the bark " of the tree called 'Ton Khoi.'

"Under my direction Mr. Beckett has made several visits to a " village where the paper is manufactured, and has procured as many " as possible of the specimens required by the authorities at Kew " Gardens.

"These specimens have been placed in two cases addressed to Kew.

"E. B. Gould."

"Ton Khoi," its Manufacture and Uses.

Mr. French, in his commercial report for the year 1885, in describing the process of the manufacture of native paper, writes as follows :—

"Native paper is manufactured out of the bark of a tree called " 'Ton Khoi.' The process of manufacture is simple. The smaller " branches of the tree are cut, and steeped in water for two or three days. " The bark is then stripped off, and brought in bundles and sold to " persons who make the paper. The bunches of bark are put in water " for two or three days by the paper maker, and, having been cleansed " from dirt, are taken out and steamed over a slow fire for two days, a " little clean stone lime being sprinkled through the bark. It is then " steeped in water in earthen jars, and more lime is added. After a " few days it is taken out of the jars, and, having been well washed to " free it from the lime, it is beaten with a wooden mallet [for about " two hours] until it becomes a mass of soft pulp. A frame of netting " about six and a half feet long, and of width varying from eighteen " to five inches, is set afloat in water, and the pulp, having first been " again mixed up in water, is skilfully poured out on to the frame so " as to be equally distributed over it. The frame is then lifted out of " the water, and a small wooden roller is run over the surface of the " pulp. By this process the water is squeezed out and the pulp pressed " together. The frame with the pulp on it is then set to dry in the " sun. In the course of some ten hours it is quite dry, and the sheet " of paper can then be lifted off the frame. It now only remains to " smooth the surface. This is done by applying a thin paste of rice " flour to the surface, and then rubbing it down with a smooth stone.

"A black paper, which is written on with a slate pencil, is made by " colouring the surface with a mixture of charcoal."

The process of the manufacture having been thus described, some additional facts regarding the tree itself, and the various uses of the paper, may prove of interest.

The place at which most of the native paper industry is carried on lies on the left bank of the River Mënam, between six and seven miles from Bangkok, consisting of a cluster of attap houses built on piles over the river and a creek which runs through their midst.

The average height of the "ton khoi" is about 30 feet. The branches grow in an irregular and straggling manner. The leaves are dark green in colour, oval in shape, and acuminated, with a serrated edge. The petiole of the leaf is very short, the venation is reticular, and there is but a single midrib.

The fruit, which is ripe during March and April, is small and dry, and is not put to any use by the natives of Siam.

The bark, in addition to being employed in the manufacture of paper, is used by native doctors for medicinal purposes. It is boiled with a large portion of salt, and, when reduced to a pulpy state, it is supposed

to allay pain, especially in the teeth, when applied internally to the affected part.

The native name for the frame of netting into which the pulp is poured is "Phaneng," the price of which is one tical (2*s.*). The price of a sheet of the paper, as it is taken off a frame 6′ $1\frac{1}{4}''$ × 1′ 1″, is one fnnang, equivalent to 3*d.* English money.

A paper of a thinner texture is also manufactured, the fineness of the texture depending on the greater or lesser admixture of water with the pulp of the "ton khoi" bark when placed in the frame of netting. This thin paper is now falling into disuse, and is gradually being relegated to remote districts of Siam, and to use by the poorer classes.

The black paper mentioned in Mr. French's Report, and of which also specimens and samples are enclosed, is made of the outer and darker peelings of the bark, whilst the white is produced from the interior lining. The paper made of the outer peelings, after undergoing the same process as the white, is smeared with a liquid mixture obtained by boiling the charcoal of the tree or shrub called "Ton Sanoh" with a certain quantity of rice. When folded in the shape of books of the better quality, the paper is usually covered with a double coating of this mixture.

The "Ton Sanoh" above mentioned is a shrub growing to the height of some 8 or 10 feet, and is of a pithy nature.

The method of writing on white paper is either by the use of a European pen and ink, or, better, by means of a native pen formed of a small piece of split bamboo, hollowed along the centre, and tapering to a point. This latter is used with Chinese ink (the same as Indian ink), which is sold in sticks at prices varying from $1\frac{1}{2}d.$ to 6*d.* a stick. To write permanent characters on the black paper requires a no mean degree of skill and practice. The pen used is the same as the one used for writing on white paper, the liquid employed being a mixture of lime either with the sap of the "ton makhuit" (a species of gum) or with a kind of chalk called by the natives "horadan." After the writing has been impressed on the paper, the whole is smeared with a coating of varnish obtained from the "ton jang," in order to fix the characters and prevent erasures.

The black books are extensively used in the native law-courts for the taking of evidence, &c. The evidence is written down by means of a chalk or steatite pencil, and is capable of easy erasure should any emendations be required. It is then read over to the witness or other person, as the case may be, and bound round with string, a seal of mud being affixed on the centre, in order to prevent the opening of the document until it is required at the trial. The witness then makes a mark in the mud seal with his nail, or, according to a more recent custom, is given a small wooden seal, with which he stamps the mud, and which he carefully preserves for the day of trial.

A scale of prices of the various kinds of paper sold is subjoined, the numbers corresponding with the numbers docketed on the samples forwarded, viz.:—

					s.	*d.*
Book No.	I. (white),	equal to	5	phanengs	=1	3
,, ,,	II. ,,	,,	4	,,	=0	9
,, ,,	I. (black)	,,	5	,,	=2	0
,, ,,	II. ,,	,,	2	,,	=0	$4\frac{1}{2}$
,, ,,	III.(unfinished),	,,	4	,,	=0	9
,, ,,	IV. (inferior quality)				=0	2

Samples of the bark in its different stages of manufacture are also forwarded, numbered and marked according to the successive stages through which it passes before its appearance in paper form; also specimens of the leaf, and of such other objects that bear upon or illustrate the manufacture of native paper as I have been able to procure.

W. R. D. Beckett.

The specimens illustrating the industry which have been deposited in the Kew museums are as follows:—

Section of trunk of tree; a frame of netting; native books, white and black; samples of material in various stages of preparation; hammer for beating bark; and mixing pot, with pigments and pens for writing.

Kew, 30th December 1887.

I have the honour to acknowledge the receipt of your letter of December 10th, transmitting a despatch in original (herewith returned) from Her Majesty's *Chargé d'Affaires* at Bangkok, forwarding a report on the manufacture and the uses of paper from *Streblus asper*.

The cases of specimens have been duly received. The collection is extremely interesting and instructive, and the objects transmitted are a very desirable accession to the museum of this establishment, where this curious industry has hitherto been wholly unrepresented.

I venture to express a hope that the Secretary of State will be pleased to convey to Mr. Gould an intimation of his satisfaction at the courteous and very intelligent manner in which Mr. Gould has assisted this establishment.

It is proposed to publish the report in an early number of the "Kew Bulletin."

W. T. Thiselton Dyer.

XXXVII.—URERA FIBRE.

(*Urera tenax*, N.E. Br.)

The fibres exhibited in the Natal Court at the late Colonial and Indian Exhibition attracted a good deal of attention. Unfortunately the labels had become misplaced in transit, and consequently the collection did not offer such facilities as could be desired for detailed investigation. It is now clearly established, however, that a fibre marked "*Hibiscus*," which attracted chief attention, was really what is known in Natal as native hemp, possibly a local form of *Cannabis sativa*. In the Official Reports, p. 378, it is stated by Mr. C. F. Cross, "that the "yarn prepared from this fibre was of a greyish colour, bleaching easily "under the ordinary treatment to a full white. It was remarkably "soft to the touch, more nearly resembling an Angola yarn than flax "or cotton. This fibre has been submitted to flax-spinners of expe- "perience, and from inspection, together with the results of laboratory "investigation, they have formed a high estimate of its value."

Mr. J. Medley Wood, A.L.S., the indefatigable Curator of th Botanic Gardens at Durban, to whose zeal and co-operation we are indebted for the elucidation of many problems connected with the flora of Natal, mentions that this native hemp grows vigorously to a height of six feet or more, and that it lends itself readily to the exigencies of culture.

M. S. del et lith.

Urera tenax, N.E.Br.

The next most interesting fibre exhibited in the Natal Court appears to have been forwarded by Mr. J. Kirkman, of Umzinto. It was stated by Mr. Wood to belong to the natural order *Urticaceæ*, but he had at that time been unable to obtain either fruit or flowers, and it was unrepresented in the herbarium at Durban.

Of nettles in Natal he states :—

"There are several indigenous varieties, some of which attain a "height of over twenty feet, with a pithy semi-herbaceous stem eight "inches in diameter. Others are more or less dwarfish, being but half "an inch thick and four to five feet high. The barks of all the varieties "are highly prized by the natives on account of the strong cord or "thread they make, in their own rude manner, from the fibre contained "therein. It is known to them by the name "*imbogo sempi*."

In a letter, dated 23rd August 1887, Mr. Woods writes :—

"By this post I send flowers of my No. 3,837, which appears to be a "*Urera*. It is a shrub about 8 to 10 feet high or more, and is, I "think, the plant producing the fibre which was said to be the second "best fibre shown at the late Colonial and Indian Exhibition.

"The plant is not uncommon in the midland districts, but this is "the first time that I have seen the flowers.

"It will be important, I think, to ascertain whether its fibre is "really of value; it grows readily from cuttings, and could be grown "in quantity if found to be payable."

Again on the 23rd November :—

"I have collected a quantity of seed for distribution, also staminal "flowers, of my No. 3,837, *Urera sp.*, but I am afraid that they are "scarcely recognisable. A specimen of bark shall be sent by next "week's post. I should like to have sent a larger quantity, but the "messenger I sent said that the trees had been stripped by the natives, "who use the bark for making their sleeping mats. I am having the "plant propagated here, in case it may be in demand."

On investigation at Kew, the plant sent by Mr. Wood proved to be a new species, which has been described and figured in the *Icones Plantarum* as *Urera tenax*, N.E. Br.

The bark, as sent here, appears to resemble in many respects that of uncleaned *Ramie* or *Rhea* (*Bœhmeria nivea*). The fibre is, however, more brittle and not so lustrous as the best specimens of China grass. Unfortunately the sample hitherto received does not admit of this new fibre being treated in an exhaustive manner. It is quite possible that an indigenous plant of this character may be better suited to the circumstances of Natal than the China grass. On receipt of a larger sample, it will then be possible to investigate its merits in an exhaustive manner.

We are enabled, by permission of the Bentham Trustees, to add a plate of this Natal fibre plant.

XXXVIII.—TEA.

(*Camellia theifera*, Griff.)

JAMAICA TEA.—Recently, three samples of tea grown and prepared at the Government Cinchona plantations, Jamaica, at an elevation of 5,000 feet, were forwarded to Kew by Mr. W. Fawcett, F.L.S., Director of Public Gardens and Plantations. An account of the experiments in tea culture at Jamaica is given in the Annual Report of the Botanical Department for the year 1884, pp. 45, 46. The first plants of tea grown at Jamaica were supplied from Kew in 1869 (*see* Kew Report, 1877, p. 21).

In 1883, and again in 1884, seeds of Assam hybrid tea were obtained by Kew from the Lebong Tea Company and the Kungra Valley Tea Association, and these enabled the Botanical Department to extend the plantations already existing, and distribute plants of this sort amongst Cinchona planters. These experimental plantations in Jamaica are the only tea plantations in the New World, and if tea were prepared to supply only local requirements there is a possibility of the industry being successfully established in the island. Various samples of Jamaica tea have been prepared from time to time, and very favourable reports have been received respecting them. It is said, "that the liquor "of all the Jamaica teas is very serviceable for the London market," and it only remains for some local effort to be made to determine the practicability of establishing an industry on a satisfactory basis. The following very promising reports on the samples of Jamaica tea sent by Mr. Fawcett have been kindly furnished to this establishment by a firm of tea merchants in the City :—

13, Rood Lane, 31st December 1887.

Sample No. 1.—Unassorted Tea.

The dry leaf is well rolled, but is much too grey in colour, and wanting in tip, somewhat uneven, and inclined to be dusty. The liquor is fairly dark and full, with some flavour. The infused leaf is regular, and of a fairly bright colour. Value, 1*s.* per pound.

Sample No. 2.—Unassorted Tea.

The dry leaf is good colour, but is too crinkley, and has not been properly rolled. The liquor is dark and full, and of a nice flavour. The infused leaf is regular, and of a fairly bright colour. Value, 1*s.* 2*d.* per pound.

Sample No. 3.—Broken Orange Pekoe.

Dry leaf is good colour, and with a few tips, but is rather open, ragged, and too uneven. The liquor is dark, full, and of good flavour. The infused leaf is bright and regular. Value, 1*s.* 8*d.* per pound.

General Remarks.

The above teas are chiefly valuable in the London market on account of their liquors, the manipulation of the dry leaf being faulty. We prefer the samples marked Nos. 2 and 3, the leaf being better in colour and liquors of finer quality and flavour. No. 1 is too soft in liquor, and resembles China tea ; Nos. 2 and 3 being more like Ceylon tea.

All the samples have a peculiar smell, and taste of some substance quite foreign to tea; for this defect we have made due allowance in our report.

The leaf of No. 2 is quite *limp*, instead of being crisp; the sample has been damaged in transit.

GOW, WILSON, & STANTON.

MADAGASCAR TEA.—The following correspondence has been forwarded to this establishment respecting experimental tea cultivation at Madagascar:—

Foreign Office, 29th September 1887.

I am directed by the Marquis of Salisbury to transmit to you herewith a copy of a letter from Mr. Pickersgill, Her Majesty's Vice-Consul at Antananarivo, to Mr. Haggard, Her Majesty's Consul in Madagascar, on the subject of tea plantations in the interior of that Island.

P. W. CURRIE.

Antananarivo, 6th May 1887.

I have the honour to inform you that an experiment in the cultivation of the tea plant in this country is being made by His Excellency the Prime Minister at one of his orchards situated about 2 miles from Antananarivo, and that there seems to be reason to believe the result will be very encouraging.

I visited the orchard a few days ago, and found nearly 200 plants in a healthy condition. They have all been raised from a small packet of seeds obtained from the Curator of the Botanical Gardens of Mauritius, and a number of them are already 18 inches high, although it is not yet 12 months since the seed was sown. If the tea plant would be successfully made to clothe the bare hills of Imerina, the preparation of the leaf and the exportation of the marketable product would afford an opening for European capital which would be well worth a trifling outlay now in the promotion of extended efforts to introduce this culture.

The publication of the present brief notice of what is an experiment made under favourable circumstances might possibly lead some one interested in the tea trade to furnish a quantity of seed direct from India or China.

I should be happy to receive and distribute such contributions to the possibilities of prosperity in Madagascar.

W. C. PICKERSGILL.

NATAL TEA.—The first plants of tea which reached Natal were sent from Kew in 1850. They were cultivated by the late Mr. Plant in the Durban Botanic Gardens. The young plants raised from the seed of these were distributed in the Colony, and laid the foundation of the present tea industry in Natal. We are informed by Mr. Brickhill, of Prospect, Umbilo, that he obtained 100 plants of the earliest seedlings, many of which are still growing with him. It is probable that these were China tea, or plants offering well marked characteristics of China tea. The results of the experimental culture of these plants showed very clearly that the climate and soil of Natal were suited for the growth of tea, and in 1877 seed of Assam Hybrid and Assam Indigenous were imported by private planters. We are informed that the prospects of tea growing were so good at this time that "the "Planters' Association memorialised the Government to bring over "from Calcutta in coolie ships, freight free, seed of Assam tea. This "the Government agreed to do. Several boxes were imported, and

" from the first batch of seeds about 5,000 plants were raised. In " 1880 the first real tea field was planted, a field of five acres containing " 10,000 plants. In 1886 the total area under tea cultivation was " about 600 acres, and the amount of tea produced was about 57,000 " pounds. It was expected last year that the amount of tea produced " would be 100,000 or 120,000 pounds."

It may be pointed out that the extent of country supposed to be suitable for tea culture in Natal is confined to a belt about 12 miles wide, running parallel to the sea. Tea has, however, been tried further inland, upon land 40 or 50 miles from the sea, where there is liability to frost, and so far it has proved successful.

The tea industry in Natal is practically in its infancy, but the results so far attained are very promising. Mr. A. G. Stanton, in the Report presented to the Royal Commission, refers to the tea exhibits in the Natal Court at the Colonial and Indian Exhibition as follows :—

" The thirty-seven samples shown in the Natal court are representa- " tive of teas ordinarily used in commerce. They are indicative of " much promise for the future success of the enterprise. Good seed " has evidently been planted, and much care bestowed upon the " manipulation of the tea. The dry leaf is for the most part well " made, and bears evidence not only of a knowledge of manufacture " but also of careful supervision. The liquors are of fair useful quality, " and possess the elements for excellent tea. As a rule, they are too " highly fired or *burnt*, a fault which requires but to be known to be easily remedied."